

WHAT IS CLAIMED IS:

1 1. A method for providing virtual space for handling storage device failures
2 in a storage system, comprising:

3 detecting a failure of a storage device;
4 allocating space for rebuilding the failed storage device's data; and
5 rebuilding the failed storage device's data in the allocated space.

1 2. The method of claim 1 further comprising:
2 replacing the failed storage devices with a replacement storage device; and
3 migrating the data rebuilt in the allocated space to the replacement storage device.

1 3. The method of claim 2, wherein the replacing the failed storage device
2 comprises hot swapping a new storage device for the failed storage device.

1 4. The method of claim 1, wherein the allocating space further comprises
2 allocating unused space in storage devices of the storage system remaining after the
3 failure of the storage device.

1 5. The method of claim 1, wherein the allocating space further comprises
2 allocating space in hot spares for rebuilding data on the failed storage device.

1 6. A method for providing virtual space for handling storage device failures
2 in a storage system, comprising:
3 preallocating virtual hot spare space for rebuilding data;
4 detecting a failure of a storage device; and
5 rebuilding the failed storage device's data in the preallocated virtual host spare
6 space.

1 7. The method of claim 6 further comprising placing into a general use
2 storage pool any of the virtual hot spare space not used during rebuilding the failed
3 storage device's data.

1 8. The method of claim 6 further comprising setting aside for subsequent
2 storage device failures any of the virtual hot spare space not used during rebuilding the
3 failed storage device's data.

1 9. The method of claim 8, wherein the preallocated virtual hot spare space is
2 mirrored, parity or striped over at least one physical storage device.

1 10. A storage system for providing virtual space for handling storage device
2 failures, comprising:
3 a processor; and
4 a plurality of storage devices;
5 wherein the processor is configured for detecting a failure of a storage device,
6 allocating space for rebuilding the failed storage device's data and rebuilding the failed
7 storage device's data in the allocated space.

1 11. The storage system of claim 10, wherein the processor is further
2 configured for migrating the data rebuilt in the allocated space to a replacement storage
3 device replacing the failed storage device.

1 12. The storage system of claim 11, wherein the processor is further
2 configured for migrating the data rebuilt in the allocated space to a hot swapped storage
3 device replacing the failed storage device.

1 13. The storage system of claim 10, wherein the processor is further
2 configured for allocating unused space in the plurality of storage devices remaining after
3 the failure of the storage device.

1 14. The storage system of claim 10, wherein the processor is further
2 configured for allocating space in hot spares for rebuilding data on the failed storage
3 device.

1 15. The storage system of claim 10, wherein the processor is disposed in a
2 controller.

1 16. The storage system of claim 10, wherein the processor is disposed in a
2 management system.

1 17. A storage system for providing virtual space for handling storage device
2 failures, comprising:
3 a processor; and
4 a plurality of storage devices;
5 wherein the processor is configured for preallocating virtual hot spare space for
6 rebuilding data, detecting a failure of a storage device and rebuilding the failed storage
7 device's data in the preallocated virtual host spare space.

1 18. The storage system of claim 17, wherein the processor places into a
2 general use storage pool any of the virtual hot spare space not used during rebuilding the
3 failed storage device's data.

1 19. The storage system of claim 17, wherein the processor sets aside for
2 subsequent storage device failures any of the virtual hot spare space not used during
3 rebuilding the failed storage device's data.

1 20. The storage system of claim 19, wherein the preallocated virtual hot spare
2 space is mirrored, parity or striped over at least one physical storage device.

1 21. A program storage device readable by a computer, the program storage
2 device tangibly embodying one or more programs of instructions executable by the
3 computer to perform operations for providing virtual space for handling storage device
4 failures in a storage system, the operations comprising:

5 detecting a failure of a storage device;
6 allocating space for rebuilding the failed storage device's data; and
7 rebuilding the failed storage device's data in the allocated space.

1 22. The program storage device of claim 21 further comprising:
2 replacing the failed storage devices with a replacement storage device; and
3 migrating the data rebuilt in the allocated space to the replacement storage device.

1 23. The program storage device of claim 22, wherein the replacing the failed
2 storage device comprises hot swapping a new storage device for the failed storage device.

1 24. The program storage device of claim 21, wherein the allocating space
2 further comprises allocating unused space in storage devices of the storage system
3 remaining after the failure of the storage device.

1 25. The program storage device of claim 21, wherein the allocating space
2 further comprises allocating space in hot spares for rebuilding data on the failed storage
3 device.

1 26. A program storage device readable by a computer, the program storage
2 device tangibly embodying one or more programs of instructions executable by the
3 computer to perform operations for providing virtual space for handling storage device
4 failures in a storage system, the operations comprising:

5 preallocating virtual hot spare space for rebuilding data;

6 detecting a failure of a storage device; and

7 rebuilding the failed storage device's data in the preallocated virtual host spare
8 space.

1 27. The program storage device of claim 26 further comprising placing into a
2 general use storage pool any of the virtual hot spare space not used during rebuilding the
3 failed storage device's data.

1 28. The program storage device of claim 26 further comprising setting aside
2 for subsequent storage device failures any of the virtual hot spare space not used during
3 rebuilding the failed storage device's data.

1 29. The program storage device of claim 28, wherein the preallocated virtual
2 hot spare space is mirrored, parity or striped over at least one physical storage device.

1 30. A storage system for providing virtual hot spare space for handling storage
2 device failures, comprising:
3 means for storing data thereon;
4 means for detecting a failure of a means for storing data thereon;
5 means for allocating space for rebuilding data of the failed means for storing data
6 thereon; and
7 means for rebuilding the data of the failed means for storing data thereon in the
8 allocated space.

1 31. A storage system for providing virtual space for handling storage device
2 failures, comprising:
3 means for preallocating virtual hot spare space for rebuilding data,
4 means for storing data thereon;
5 means for detecting a failure of a means for storing data thereon; and
6 means for rebuilding the failed storage device's data in the preallocated virtual
7 host spare space.